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Cover

Lofty View of Volcano—A NASA/Ames Research Center U–2 aircraft took this oblique view of the erupting Mount Saint Helens in Washington from an altitude of 65,000 feet. The picture was made from the west side of the mountain. To the north, the snow appears white while on the southeastern slope, covered with ash blown by prevailing winds, it looks grey. Tracks along the mountain side are avalanche trails. The U–2 from Ames photographed the volcano with three 24-inch focal length cameras. View was taken prior to the volcano's fierce eruption in mid-May.

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Shuttle Flight Engines Due Retest

The three Space Shuttle main engines designated for the first flight of the orbiter Columbia will be tested again to assure operational readiness for the flight. The engines, acceptance-tested between April and July 1979, are being shipped from the Kennedy Space Center to the NASA testing facility in Mississippi for reacceptance firings.

The process will take two to three months and is expected to have no effect on the timing of the space Shuttle's first flight, now anticipated between November 1980 and March 1981.

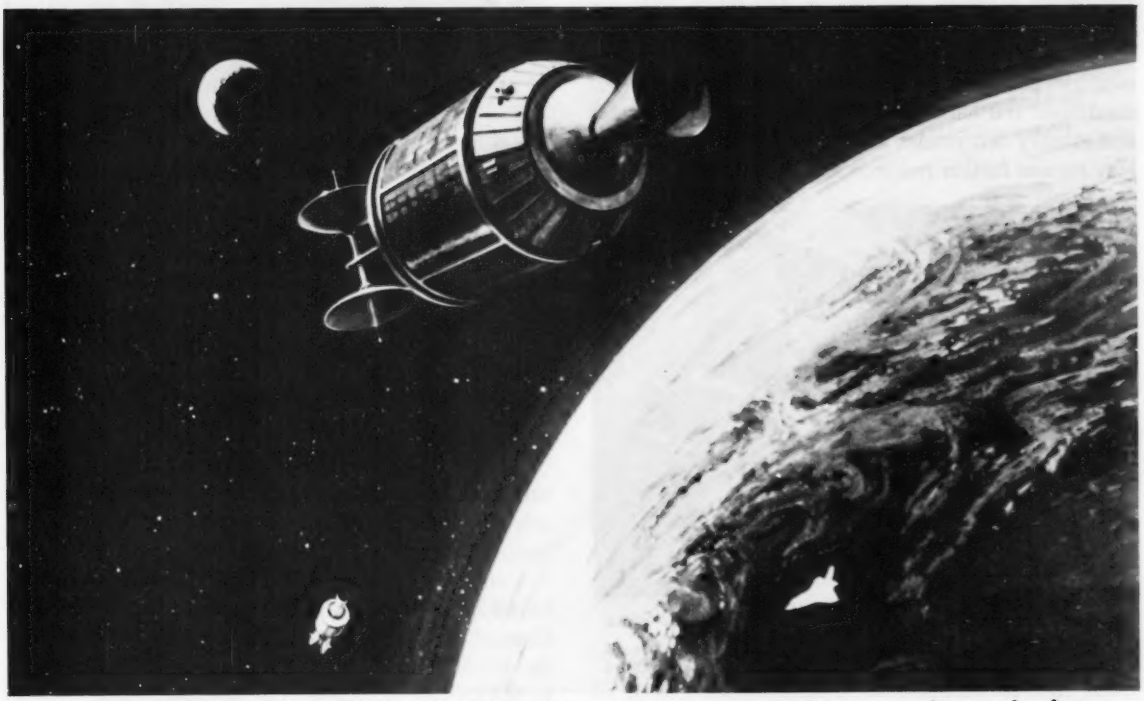
The decision to retest the engines was based on the number of modifications that have been made during the past year. These concerned high pressure turbopumps, valves and nozzles.

Each engine will be operated on the test stands at the National Space Technology Laboratories, Bay St. Louis, Miss. After the trials, the engines will be returned to Kennedy for installation in the Columbia. About six weeks before the first flight, the engines will be fired once again, for 20 seconds, on the launch pad.

Earlier, the third static test of a Space Shuttle main engine was completed in April, and described as "highly successful" by officials at NSTL. This was the final in a series of tests with simulated power levels necessary for an "abort to orbit" during a Shuttle launch.

The engine (No. 2004) was fired for 10 minutes and 10 seconds, with six minutes of the test at the 109 percent power level. This engine has now completed a total of 12,911 seconds (3.58 hours) firing time, equivalent to about 25 flights of the Space Shuttle.

A planned 10-minute test of the Space Shuttle's main engine cluster terminated automatically after about six seconds in mid-April. Probable cause of the shutdown has been identified as a discharge overtemperature on the high pressure fuel turbopump of engine No. 2 of the three-engine cluster. There was no apparent damage to the engines or test stand.



Shuttle's Satellite Payloads—In artwork released by Rockwell International, ComSat satellites are seen in space far above a tiny Space Shuttle orbiter figure circling the Earth. When they become operational, orbiter vehicles can release such communications payloads from their cargo bays. Apogee kick motors attached to the satellites will thrust them into higher, geosynchronous orbits.

Orbiter Thermal Shield Explored

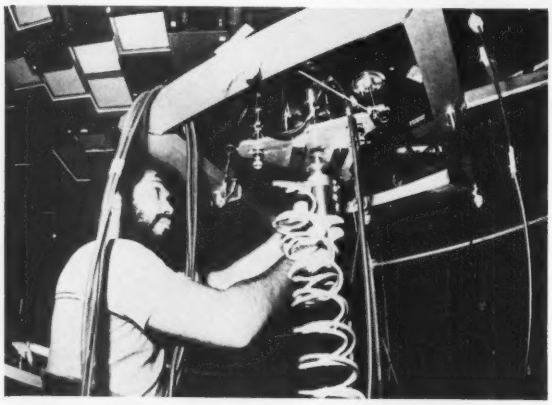
The space agency is requesting proposals from private industry for a design study of alternate thermal protection systems for the Space Shuttle orbiter. The study's results will not affect present orbiter vehicles, but promising alternative systems will be considered for later application.

Proposals for the nine-month assessment were due one month ago and the study should begin in late June. It will be managed by the Langley center.

Major goals of the study are to reduce the costs of the orbiter's thermal protection system and to determine the best available system, whether it is the present one or an alternate one.

The present ceramic system was selected in the early 1970s as the best then available. No detailed assessment of alternate systems has been conducted since that time, however. The new study will bring into focus any recent technological advances in reusable surface insulation.

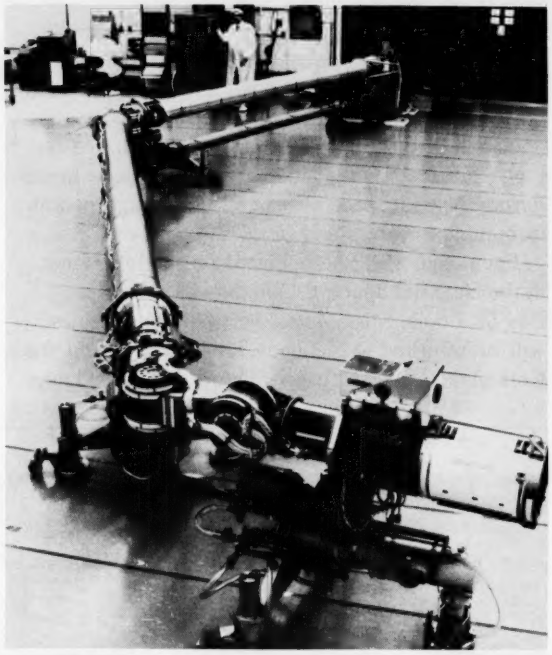
The study will include evaluation of such types of thermal protection systems as metallic and reinforced carbon/carbon concepts, which are considered probable alternatives. The study will assess potential benefits and problems that might result from alternate thermal protection concepts; establish guidelines to cope with varied loading conditions and handling, inspection and maintenance; and identify deficiencies in present technology that may require further research and development.



Tugging at Orbiter Tile—A technician at the Kennedy Space Center, working under the belly of the orbiter Columbia, adjusts his device to proof test individual thermal protection system tiles. The vacuum-powered pulling fixture is being used on most of the orbiter's 31,000 silica fiber tiles to verify their ability to withstand repeated launch and reentry stress. NASA is considering a study of alternate thermal protection systems for future Space Shuttles.

NASA Contract for Shuttle Manipulators

The Johnson Space Center has signed a contract with Canadian Commercial Corp. of Hull, Quebec, covering production of three remote manipulator systems for the Space Shuttle orbiter. Valued at $63,640,000, the cost-plus-fixed-fee contract will be 100 percent subcontracted to Spar Aerospace Ltd.



Long Arm of Shuttle—The flight article of the first Space Shuttle remote manipulator system arm lies on the air bearing floor of the Spar Aerospace facility in Toronto, Ontario, Canada. The complimentary robot arm was provided by Canada under a 1975 agreement and NASA has now contracted for three more remote manipulators for use on the Shuttle orbiter.

of Toronto, Ontario. The contract formalizes a NASA letter contract issued May 1, 1979.

The remote manipulator system is a long, jointed arm operable from within the orbiter's crew compartment to deploy or retrieve payloads in space. The arm is 15.2 meters long.

Under a 1975 memorandum of understanding between NASA and the Canadian National Research Council, Canada developed the first flight unit of the remote manipulator system and will provide it to NASA free of charge. The agreement also provided that NASA would procure from Canada additional systems as required to support NASA programs.

Testing Seniors for Stresses

Can humans older than 55 withstand the physiological stress of weightlessness riding aboard Space Shuttle? To answer that question, the space agency for the first time is subjecting males aged 55 to 65 to prolonged bedrest, a way to simulate the weightless environment of space flight.

The test subjects are the oldest people to undergo simulated weightlessness at NASA. Four previous studies at Ames Research Center tested males and females aged 35 to 45 and 45 to 55.

Forty-six males, aged 55 to 65, reported for the first briefing at Ames in early February. Of the 44 who reported for physical examination, 25 were found fit enough to participate in preliminary testing—10 of these were in the 60-65 age group. Twenty were selected to report for orientation with the other five serving as alternates.

The preliminary orientation and testing serves a dual purpose: It gives Dr. Harold Sandler, Ames project scientist, an opportunity to see how subjects perform and it also allows the subjects an opportunity to decide whether they want to participate.

Two sets of four subjects were admitted to Ames' human research facility for nine days of controlled observations, 10 days of bedrest and five days of recovery and post-bedrest tests of the cardiovascular system.

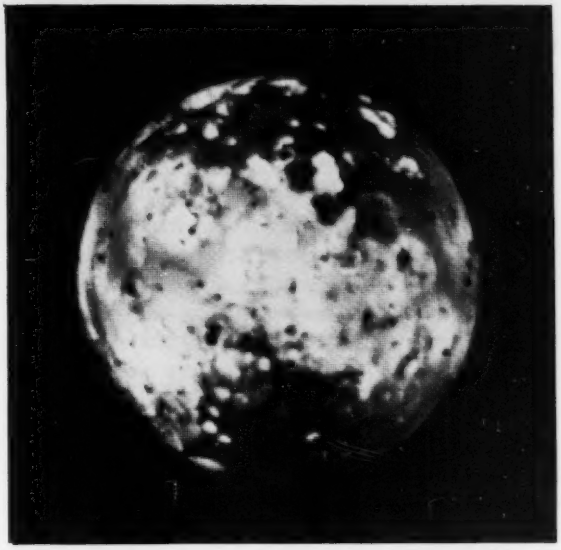
According to co-investigator Dr. Danielle Goldwater, preliminary indications are that healthy men in that age group would be able to participate in future Shuttle flights.

Jovian Moons Being Mapped

A major step in accurately mapping Jupiter's four large moons has been completed by Merton E. Davies of Rand Corp., Santa Monica, Calif., and several colleagues, based on photographs from NASA's Voyager spacecraft.

Using many of the 33,000 pictures of Jupiter and its Galilean satellites taken by Voyager 1 in March 1979 and by Voyager 2 in July 1979, Davies and his colleagues have put together geodetic control networks that will be used internationally by astronomers and planetary scientists in making and using maps of the bodies.

Geodetic control networks are used to compute geographic coordinates of features on the surface.



Moon of Jupiter—Taken from 2.6 million kilometers, the Jovian moon Io is large enough to be a planet in itself. Along with Jupiter's three other large moons, Io is being mapped by the Rand Corporation using Voyager pictures.

They are also used to determine latitudes and longitudes for preparation of maps.

In addition to the new control networks, Davies and his colleagues accurately established radii of the four satellites—Io, Europa, Ganymede and Callisto. Those radii are:

- Io = 1,816 ± 5 kilometers
- Europa = 1,563 ± 10 km
- Ganymede = 2,638 ± 10 km
- Callisto = 2,410 ± 10 km

Control networks for the satellites contain: Io, 307 points, 159 pictures; Europa, 86 points, 46 pictures; Ganymede, 227 points, 71 pictures; Callisto, 291 points, 95 pictures. The control networks and resulting maps will help astronomers and planetary scientists to maintain an accuracy never before possible.

Voyager's narrow-angle camera gives a 1 km resolution from a distance of 50,000 km. Closest approaches to the satellites were as follows:

Satellite	*Voyager 1 Distance*	*Voyager 2 Distance*
Io	20,570 km	1,129,900 km
Europa	733,760 km	205,720 km
Ganymede	144,710 km	62,130 km
Callisto	126,400 km	214,930 km

The Jet Propulsion Laboratory in Pasadena, Calif., the government-owned facility operated for NASA by the California Institute of Technology, manages the Voyager project for NASA's Office of Space Science. The two Voyagers are now enroute to encounters with Saturn. Voyager 1 will arrive in November 1980; Voyager 2 will arrive in August 1981.

Large Space Antenna Study

Marshall Space Flight Center has received proposals from several companies interested in defining a space flight experiment that would demonstrate, in low Earth orbit, the characteristics and performance capabilities of a large space antenna system. Such a large system, if put into wide future use, could significantly change communications, radar and radiometry operations from satellites.

The Marshall center plans to select two companies to conduct parallel 12-month definition studies. Large antenna systems may be the answer to many problems that now prohibit expansion of satellite communications, Earth resources surveys, weather research and other services. Dozens of smaller satellites, each with its own antenna, now provide such services. The growing number of these independent satelites is rapidly depleting available transmission frequencies, requiring more and more ground receiving stations, and filling up available space in required geosynchronous orbits over the Earth's equatorial region.

As a step toward the use of large space antenna systems, the Marshall center plans a large experimental antenna that could be flown in low Earth orbit for test and demonstration purposes. This demonstration, to be defined under the study contracts announced, would verify the antenna's structural integrity and test methods of packaging, transportation and orbital deployment.

Presidential Good Wishes

In January, the National Aeronautics and Space Administration was recognized for its efforts in implementing the Civil Service Reform Act of 1978 and given the new award sponsored by Reps. Morris K. Udall and Edward J. Derwinski. Last April 11, NASA Administrator Dr. Robert A. Frosch received the following letter from the White House:

To Bob Frosch

I want to congratulate the National Aeronautics and Space Administration on receiving the first Udall/Derwinski Award for excellence in civil service reform implementation. Civil service reform is the most effective method we have for bringing better management and increased productivity to the Federal Government, and my sincere thanks go to the men and women of your agency for the exemplary role they have played in making that reform a reality.

The leadership and professionalism demonstrated by NASA in establishing its Senior Executive Service and in designing and administering performance appraisal systems are helping to ensure the success of such programs throughout Government. My congratulations on a job well done.

Sincerely,
Jimmy Carter

Smylie to Head Tracking and Data

Robert E. Smylie, Deputy Director of Goddard Space Flight Center has been named Associate Administrator for Space Tracking and Data Systems at NASA Headquarters effective April 20.

In his new position, Smylie will be responsible for planning, development and operation of global tracking networks, facilities and systems for communications and data acquisition and processing for all space flight programs.

He became Deputy Director of Goddard in December 1976 and was Acting Director June 1979 to February 1980.

Prior to that he was Acting Associate Administrator for Aeronautics and Space Technology at NASA Headquarters, July–December 1976 and Deputy Associate Administrator for Aeronautics and Space Technology from October 1973 to July 1976.

From 1962 to 1972, Smylie was assigned to Johnson Space Center, Houston, where he was

Chief, crew systems division; Assistant Chief for Apollo support, crew systems division; Chief, Apollo support office; and Head, environmental control systems branch, life systems division. In these positions, he was responsible for activities in support of the Apollo and Skylab programs. He was U.S. chairman of the working group concerned with crew transfer and life support systems for the Apollo Soyuz Test Project.

Before joining NASA in 1962, Smylie was employed by the Douglas Aircraft Co., Santa Monica, Calif., where he was responsible for various systems in the development of the DC-8 aircraft. Upon completion of the DC-8 program, he led a research group concerned with air conditioning problems associated with the supersonic transport and subsequently was assigned as lead engineer for the Skybolt missile thermal conditioning systems.

Smylie graduated from Mississippi State University and received a master's degree in mechanical engineering. He completed the requirements for a master's degree in management as a Sloan Fellow at Massachusetts Institute of Technology in 1967. In addition, he has done graduate work at the University of California, Los Angeles.

He has received the NASA Exceptional Service Medal, and the Victor Prather Award as well as various Johnson center awards. He is an Associate Fellow of the American Institute of Aeronautics and Astronautics and a Fellow of the American Astronautical Society.

Smylie, his wife June, and three children reside in Clinton, Md.

Options for Landsat-D Program

The Space Agency is studying options to restructure its Landsat-D project because of increasing engineering and managerial problems encountered in the manufacture of the spacecraft's instrument and ground systems.

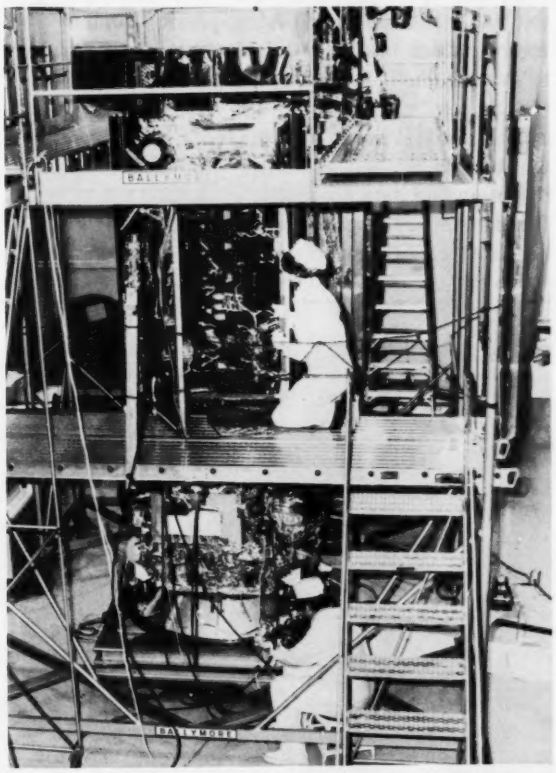
Landsat-D is the fourth, and most technologically advanced, spacecraft in a series of experimental Earth resources monitoring satellites to be developed by NASA. Although designed with a one-year lifespan, each of the first two Landsats, launched in 1972 and 1975, respectively, stayed in orbit and sent back data for five years.

Landsat 3, launched in March of 1978 with a designed lifespan of one year, is still operating but has experienced problems with its sensing device called a multispectral scanner, which collects data to be converted to images of Earth's natural resources.

Landsat-D has been designed to carry an advanced scanning device called a thematic mapper which should define Earth imagery in more spectral bands and with twice the resolution (30 meters) of the multispectral scanners of the earlier Landsats.

Problems encountered by the Hughes Aircraft Co. in building the thematic mapper have resulted in sharply increased cost estimates and delivery delays. In addition, the mission system contractor, the General Electric Co., also is experiencing problems and projecting schedule delays resulting in greater anticipated costs for development of both the flight and ground systems it is building for Landsat-D.

Both problems impact the current Landsat-D



Preparing NOAA–B's Debut—Surrounded by three stories of scaffolding, the latest NOAA weather satellite undergoes final testing at RCA Astro-Electronics in Princeton, N.J. The satellite, becoming NOAA 7 on achieving orbit, will provide detailed information for the nation's weather forecasts. Operated by the National Oceanic and Atmospheric Administration, the weather satellites are under NASA management for procurement and launching.

launch schedule, thus increase the risk of creating a gap in the flow of Landsat data to the users.

The three options being considered by NASA officials that keep in mind current budget constraints and yet provide Landsat-D capability as soon as possible are:

- Launch Landsat-D at the earliest possible time, carrying a thematic mapper and a multispectral scanner;
- Launch Landsat-D with only a multispectral scanner as quickly as possible to be followed as soon as possible with another Landsat equipped with a thematic mapper and a multispectral scanner;
- Launch Landsat-D and Landsat-D Prime (backup), each with only a multispectral scanner.

In making its analyses, NASA is consulting with the National Oceanic and Atmospheric Administration, which has been designated by the President to manage the follow-on operational Earth remote sensing satellite system.

The Landsat program is managed by NASA's Office of Space and Terrestrial Applications. Signal reception and data processing is handled by Goddard Space Flight Center, Greenbelt, Md., which exercises mission operations control.

NASA, SBA Sign Agreement

The National Aeronautics and Space Administration has signed an agreement with the Small Business Administration to participate in a special cooperative program to help develop small business concerns owned and controlled by socially and economically disadvantaged individuals.

The compact is similar to the program spelled out in Section 8(a) of The Small Business Act as amended by Public Law 95–507 and calls for the development of minority firms through contracts and subcontracts to them through both NASA and the SBA.

Under the agreement, signed by NASA Administrator Dr. Robert A. Frosch and Small Business Administrator A. Vernon Weaver, both agencies can identify particular procurement requirements relating to the special program. The NASA Administrator, however, will retain final say in the award of any contracts under this program.

The Small Business Administration has indicated that it will provide management and technical assistance, advance payments, and business development expenses as appropriate to any minority firms awarded contracts under this special agreement.

The cooperative program will run through

Awards Time at Marshall—At a recent ceremony in Huntsville, Dr. Robert A. Frosch presented awards to the Marshall center personnel responsible for the three-mission High Energy Astronomy Observatory program success story. From the left, Dr. W. R. Lucas, Marshall Center Director; the NASA Administrator, congratulating Dr. Fred A. Speer, who received the NASA Distinguished Sevice Medal for managing the HEAO project; Fred S. Wojtalik, HEAO chief engineer, recipient of the NASA Outstanding Leadership Medal; and Dr. Thomas A. Parnell, HEAO 3 project scientist, who was awarded the NASA Exceptional Scientific Achievement Medal. In all, thirty-three Marshall employees were presented individual awards and 78 were honored for their part in team efforts.

September this year. The program can be extended beyond that time if both agencies agree in writing.

In addition to participation in the special cooperative program, NASA has also stated that it will exert its best efforts to achieve three different goals in the area of minority and small business contract awards.

The first is to set a goal of $118.5 million for minority business contracts, of which $51 million would be to the Small Business Administration for further subcontracting to individual firms. The second goal is to achieve $369 million in direct contract awards to small businesses (minority awards included). The final goal is to establish a small business subcontract goal of $386 million for work subcontracted from major NASA contractors.

All of these goals are to be achieved in the remainder of the 1980 fiscal year, ending Sept. 30.

Kudos from Without

Dr. M. Patrick McCormick, Head of the aerosol measurements research branch, Instrument Research Division, at the Langley center has been presented the Arthur S. Flemming Award by the Downtown Jaycees of Washington, D.C. Honored as one of 10 outstanding young Federal Government employees of 1979, McCormick received the Flemming award for his achievements in the development of instrumentation and measurement techniques for the analysis of particulate aerosols in the atmosphere.

William J. O'Donnell, Chief of the media services branch in NASA Headquarters Public Affairs was chosen "top U.S. Government public affairs officer for 1979" by the Aviation/Space Writers Association. The award is recognition, in part, for Bill O'Donnell's outstanding job on the Skylab recovery story last year and for his long career in Federal public information. The nomination was supported by a "Who's Who" of national aerospace reporters from newspapers, magazines and television.

Robert L. Pike, Chief of the Personnel Division, Ames Research Center, recently received the Commander's Award for Civilian Service from the U.S. Army Research and Technology Laboratories (AVRADCOM). Pike was cited for his "professional approach, innovative ideas and superior managerial talent in successfully integrating the Army research lab's personnel system into the NASA Ames system during the period March 1979 to March 1980."

David Lorincz, an aerospace technologist (architect) in the Plant Engineering Division, LRC, has been selected to participate in the Rotary Foundation group study exchange program. As recipient of an honor sponsored by Rotary International, Lorincz will spend five weeks in Japan exchanging design methods and construction techniques with Japanese architects, engineers and other professionals. He will also visit various universities.

New Dish at Ames—Technicians are dwarfed by the 11 meter satellite communications antenna recently installed at Mountain View, Cal., which will bring project engineers at the Ames center real time test data from research aircraft flying over the Mojave Desert, some 460 kilometers away. The new system is being used in the initial expansion of the NASA/Army Tilt Rotor Research Aircraft flight envelope. Feedback between the Ames project office, flight controllers and the pilot in the air is by voice circuit.

A Marshall employee searches through the "stacks" of 400,000 hardcopy documents on file.

Handling the Document Explosion

In the NASA world of high technology, the management of information as a resource presents a demand of epic proportions. Documentation of the agency's myriad endeavors and projects is a continuous job, increasingly complicated and always expanding. This month, Idea Clearinghouse of the NASA Headquarters Information Systems Division has cited the Kennedy and Marshall centers for their handling of this functional management responsibility. Both are using technology to counter the technological paperwork.

Lee Roy Hoekenschnieder, Marshall's repository functional manager, said increasing costs of paper and film have mandated the use of improved techniques and technological advances.

To save money and still meet the 10-day turnaround on providing documentation for nearly 3,000 distribution lists, the repository is going to microfilm and microfiche. "If we didn't, it would take a facility twice as large to handle the reproduction, storage and dissemination tasks we have now," Hoekenschnieder said.

"We estimated that the average document is 60 pages and costs about $3.75 to reproduce in hardcopy. Microfiche of the same document costs about 79 cents. Lower postage rates for the less bulky film account for other appreciable savings." According to Hoekenschnieder, almost 50,000 documents were distributed by the repository during the first month of 1980.

KSC, meantime, reduces costs and increases productivity by processing its engineering drawings and documents through a specified center, incorporating microfilm, computer inputs and filing. The process is defined for users through detailed written instructions and preliminary engineering releases are used to speed the flow of data between the designer and the office in the field.

The magnitude of the document task is borne out by the statistics of the Marshall center alone—more than 10 million microfiche cards, 50,000 drawings and 400,000 hardcopy documents are on file there.

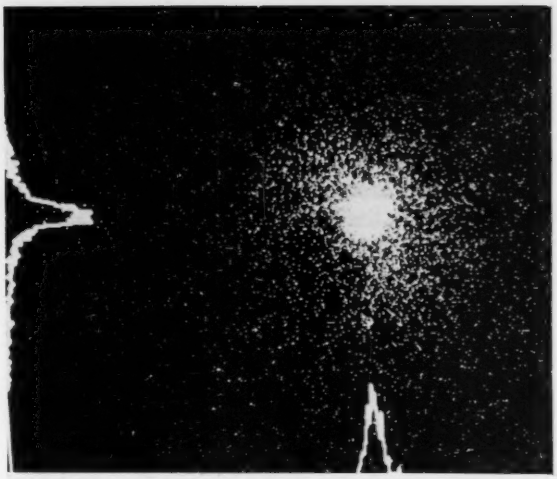
NASA Extends Delta Services

A $70,072,000 follow-on fixed price-incentive contract has been issued to the McDonnell Douglas Astronautics Co., Huntington Beach, Calif., for Delta expendable launch vehicle services. The contract calls for continuation for two years of launch services work performed by the company for the past 19 years for Delta including mission peculiar vehicle changes, checkout and launch.

The services will be performed at the McDonnell Douglas plant in Huntington Beach, at the Eastern Space and Missile Center, Fla., and at Vandenberg Air Force Base, Calif.

The Delta has been used to launch 151 weather, communications and scientific satellites, both foreign and domestic, government and commercial, of which 140 were successful launches.

The Kennedy Space Center is responsible for supervision of Delta activities to the Goddard Space Flight Center, which in turn is responsible for overall technical project management of Delta for the NASA Office of Space Transportation Operations, Washington, D.C.



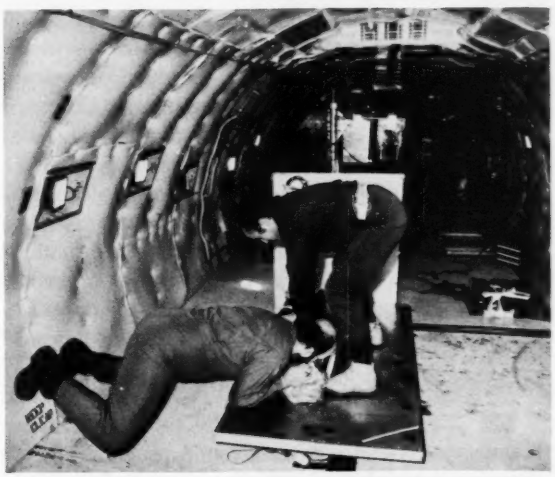
Pulsar According to HEAO—The second High Energy Astronomy Observatory (HEAO 2) continues to send back data of unprecedented detail. In this X-ray image of the Vela supernova remnant, a pulsar emitting radio waves is seen at the center. The Marshall center HEAO, with its computer processing system, is able to record and display the total number of X-ray photons on a scale along the margins of the picture. Astronomers can study the fine details of brightness variations otherwise lost in the X-ray image.

Satellite To Aid Timber Industry

An Earth resources NASA satellite has found a new use: gathering data to improve management of America's forest lands. The project reflects a unique relationship between the government agency and the private sector, one in which the initiating company is sharing the total cost but the technology developed will be available to all other timber companies. The satellite is Landsat 3. The company is the St. Regis Paper Co., New York.

Since 1977, St. Regis has been working with NASA in a test program to see if Landsat data could improve the paper industry's information base on forest lands. The company wants to use the data for planning timber harvests, leasing and buying new timber lands and to monitor more than 920,000 hectares (2.3 million acres) across the South.

The project has been so successful that the St. Regis Southern Timberland Division Jacksonville, Fla., recently authorized over $300,000 of new capital investment for a forest resource information system to use Landsat data to supplement conventionally acquired data in its general operations.



Airborne Resuscitation Drill—Aboard a NASA KC–135 flying out of JSC, the group consists of two paramedics and one mannequin, performing the two person method of cardio pulmonary resuscitation. The medics, working in 30 seconds of zero gravity, are Dr. Joseph Degioanni (standing) and technician Christopher Counts; the mannequin (supine) is Resusci-Annie, an old hand commonly used by the American Heart Association in demonstrations. Both Dr. Degioanni and Annie are wearing the newly developed restraint straps for zero gravity first aid.

The entire forestry industry stands to gain from the venture because technology developed by the St. Regis experiment is in the public domain and available to other companies. The company and NASA plan to conduct a symposium in 1981 to demonstrate Landsat interpretation methods to timber industry managers.

St. Regis was the first private company to act as a user in NASA's resource observation applications test program. The project established a unique relationship between the agency and the private sector, for St. Regis initiated the project—rather than NASA—and the company is sharing in the total cost.

St. Regis will use techniques developed in the project at its Dallas computer facility to process the data coming from Landsat which will complement the automated data base at the St. Regis divisional remote sensing center in Jacksonville. This combined data will assist the company in estimating timber volume and productivity, as well as changes in the conditions of the forests.

Landsat data will be used to determine distribution of the major types of trees on St. Regis-owned timberland in Texas, Florida, Georgia, Alabama, Mississippi and Louisiana and other land available through lease or purchase.

The project is being conducted by Johnson Space Center, Houston; the laboratory for applications of remote sensing at Purdue University in Lafayette, Ind.; and the St. Regis Paper Co. It is scheduled to end in September of this year.

Landsat 3 orbits the globe 14 times a day at an altitude of 900 kilometers. Its electronic multispectral scanner returns data which is processed into film and computer tape format. This resource information may be used to characterize different types of terrain, vegetation, soils, rocks and other surface features.

Langley Environmental Office Meets Goal

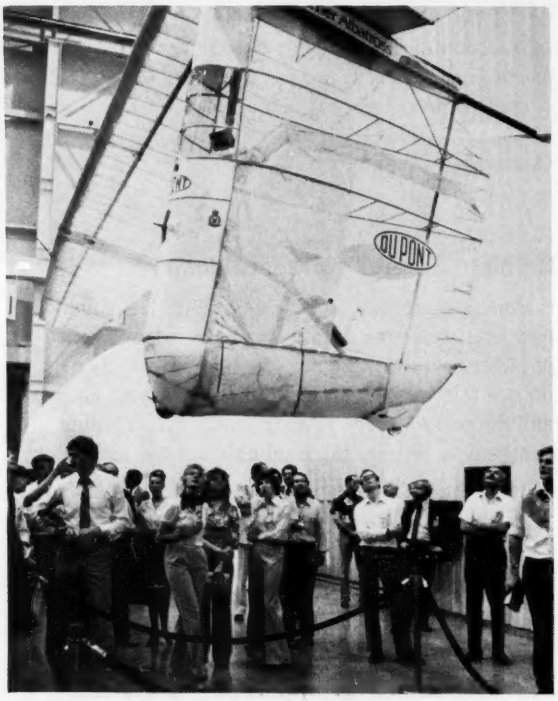
The office at Langley Research Center that literally got NASA's environmental program off the ground during the 1970's has successfully completed its mission and closed its doors.

The Environmental Quality Projects Office was established at Langley in 1972 to lead agency efforts to plan and implement an environmental quality program. With its assignment completed, the office has turned future work over to the NASA Headquarters Office of Space and Terrestrial Applications in Washington.

In the early 1970's, in response to a growing national concern for protecting the quality of the environment, NASA decided it could help by monitoring and interpreting enviromental data from satellite-borne experiments.

Langley was chosen as the NASA focal center for the work because of its leadership in remote sensing research and in advanced instrumentation developments. At the same time, other NASA centers were given similar responsibilities: Johnson Space Center, earth resources studies; Goddard Space Flight Center, meteorological research; and Ames Research Center, aircraft flight programs.

An environmental office, while physically located at Langley, reported directly to NASA Headquarters, coordinating the research of several NASA centers



Gossamer Albatross on Display—Visitors and employees at the Johnson Space Center get a look at the fragile contraption that flew the English Channel. The pedal-powered Albatross went on exhibit in April in JSC's Building 9A, the Space Shuttle mockup and integration facility laboratory. The opening day crowd was addressed by Bryan Allen, the young man who piloted (pedalled) the craft across the channel in 1979. More than just an exhibit, a Gossamer Albatross sister ship has been carefully tested in a joint NASA Langley-Dryden flight research program to study the future of light-weight, low-speed aircraft.

Senior Senator Visits Goddard—Center Director A. Thomas Young, right, escorts Sen. Charles McC. Mathias, R-Md. on a tour of the Goddard Space Flight Center's Solar Maximum Mission facility and domestic information display system. Maryland's Senior Senator, a member of the Appropriations Committee, also discussed with Young and his staff the impact of recent budget cuts and the present status of space programs.

and making program and budget recommendations to Headquarters.

The Langley share of environmental quality research has grown from a $50,000 program employing about 25 people to a $20 million program that—at its height—had more than 200 people, not counting the Environmental Quality Projects Office itself. The office never numbered more than 17 people at Langley, but they were in the middle of many projects.

John Mugler, last head of the office, is quick to point out that the contribution of his relatively small staff was primarily administrative: to formulate, package and promote the kinds of environmental research projects they thought NASA could do best. The most visible evidence of the NASA work has been the orbiting of environmental experiments aboard a continuing series of satellites.

While public attention was focused on the diplomatic significance of the Apollo-Soyuz mission in 1975, a Langley experiment aboard the Apollo spacecraft was quietly taking environmental measurements in the stratosphere. SAM (stratospheric aerosol measurement) was one of many experiments that flew on the mission, but it marked the beginning of the NASA space flight program for environmental research as formulated by the environmental quality office.

The first mission dedicated to monitoring environmental quality was the Nimbus-G satellite, launched in September 1978. Three Nimbus experiments investigated air pollution: one was contributed by the United Kingdom, and two are products of work sponsored at Langley by the environmental office. One Langley experiment, LIMS (limb infrared monitoring of the stratosphere) is providing infrared measurements of ozone, water vapor, nitrogen dioxide and nitric acid; the second Langley experiment, SAM II, is taking a closer look at aerosols in the atmosphere.

SAGE (stratospheric aerosol and gas experiment) added to the alphabet soup of satellite-launched experiments in eary 1979. Its sole mission is to determine the distribution of stratospheric aerosols and ozone on a global scale.

Satellite measurements of the Earth allow a broad view of pollution and weather systems that transport it. Pollution that begins in one region may often affect either the environmental quality or the weather of another region but, without the long-distance view of an orbiting spacecraft, it may not be obvious.

A favorite example cited by Bob Rinehart, Environmental Quality Projects Office technical assistant for eight years, is a satellite picture of Gary, Ind., and the eastern shore of Lake Michigan, taken one recent winter. Without that picture, it would have been very difficult to convince a steelworker in Gary that pollution from his plant and others contributed to a snowstorm on the shore of Lake Michigan, 75 to 100 miles northeast of Gary.

The photo was as clear as a roadmap. Particulates from the steel mills had combined with water vapor and could be seen as cloud-like plumes extending from Gary straight into a huge cloud over the eastern half of the lake. Exactly parallel to the cloud, for many miles inland, was a white blanket of freshly fallen snow.

In spite of impressive technological achievements by NASA in designing remote environmental sensors and putting them into orbit, Mugler puts those achievements into perspective by explaining that "the satellite flight programs are a means to an end, not the end product itself."

The success of the multi-center research program that has evolved is measured in the vast amount

of useful information that NASA experiments have made available to the scientific community and to agencies like the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, the United Nations and others.

The growth of NASA's program has also been good for the agency and for Langley, according to Mugler. "Because of our focal center responsibilities," he says, "Langley has been able to build an aggressive, and still enlarging, atmospheric and water quality program.

Investigations for Atmospheric Studies

The National Aeronautics and Space Administration has selected 26 scientific investigations to be studied for possible inclusion aboard two Upper Atmosphere Research Satellite missions proposed for the late 1980s.

The missions will focus on a comprehensive investigation of the Earth's stratosphere, mesosphere and lower thermosphere to better understand the Earth's upper atmosphere, the response of the ozone layer to changes and the role of the upper atmosphere in climate and climate variability.

NASA officials emphasize that the program has not yet been approved by Congress, but early solicitation of scientific participants and investigations allows for mission definition and a prompt start when approval is received.

The 26 investigations, 23 from the United States, two from the United Kingdom and one from France, include 16 experimental and 10 theoretical investigations. They were selected from 75 proposals received by NASA in response to an announcement in September 1978.

Some 90 other researchers are associated with the selected investigations. The U. S. investigators are from eight universities, six government laboratories and two private organizations.

Each country will be responsible for funding its own investigations and its participation in support of instrument development. The initial study phase cost to the United States, including the selected U.S. investigations, is expected to total about $5 million over two years.

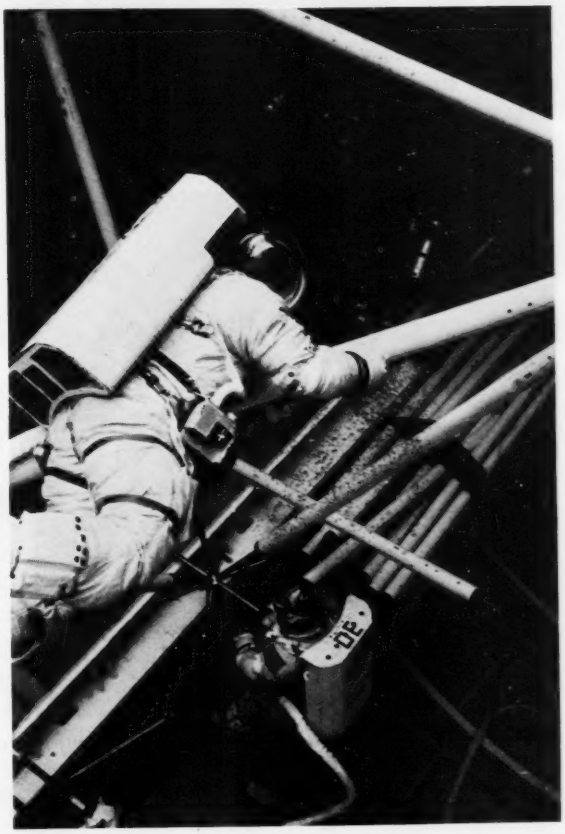
Focusing on the atmosphere between 10 and 20 kilometers altitude, the proposed program will use remote sensors to measure trace gases, temperature, winds, and energy influx and losses. Theoretical studies, including atmospheric simulation modeling, will be closely coupled to the experimental measurements.

The program as presently proposed would involve two satellite missions, each with a nominal lifetime of 18 months. Launched one year apart, the two satellites should provide a total nominal data period of 30 months. The satellites will be carried into orbit by the Space Shuttle.

To allow the first satellite to observe each local area at a variety of different local times, it will be placed into a 56 degree inclination orbit. The second mission is proposed for a 70 degree inclination orbit to provide global coverage and measurement of high latitude energetic processs.

The proposed missions are part of the Environmental Observations program of the NASA Office of Space and Terrestrial Applications. The project management, including the selected investigations, is the responsibility of NASA's Goddard Space Flight Center.

Dryden's Immortal "Gooneybird"—Amid triplesonic YF–12 aircraft and sleek, needle-nosed research jets, a venerable C–47 still serves in the Dryden center's flight operations. The C–47 (civilian DC–3) is probably the world's most honored plane and this one was built at the Douglas plant in Oklahoma City in 1943. Dryden's aircraft flies personnel and material to the various dry lakebeds in support of research projects. Recently, it was used as a test bed, carrying a system that visibly showed the presence of wing tip vortices in flight.



Some Heavy Lifting—Astronauts Bruce McCandless and Joseph Kerwin train for the future and the potential of permanent structures and platforms in space. Using the neutral buoyancy simulator tank at the Marshall center, assisted by swimmers, the astronauts are evaluating methods and equipment that might be employed to service large structural beams in the space environment.

Lewis Awards Fuel Cell Contract

A $4-million contract to United Technologies Corp., Power Systems Div. of South Windsor, Conn., has been awarded to develop further fuel cell technology for electrical utility applications.

The 18-month agreement was made under the Development of Energy's phosphoric-acid fuel cell systems program, managed by NASA's Lewis Research Center, Cleveland, in the continuing effort to develop high-efficiency, fuel-flexible power generation technologies to reduce U.S. dependence on scarce fuel while meeting environmental standards.

The bulk of the phosphoric-acid fuel cell technology development effort to this point has been directed to demonstrating the operational feasibility of a precommercial 4.8-megawatt power plant. It is recognized, however, that the key to developing commercially viable power plants hinges on advancing the basic fuel cell and stack technology to a level which offers improved cost, performance and operating life.

Work to be performed under this contract will involve further identification and evaluation of low cost cell materials with greater corrosion resistance, catalysts with improved activity and stability, and electrode structures with greater tolerance to higher temperature and pressure operating conditions.

The materials, catalysts and structures are to be evaluated in both subscale single cell and full scale stack endurance and performance tests. Also, technology development work will be done on processing the cell structural elements in the large size anticipated for commercial scale systems.

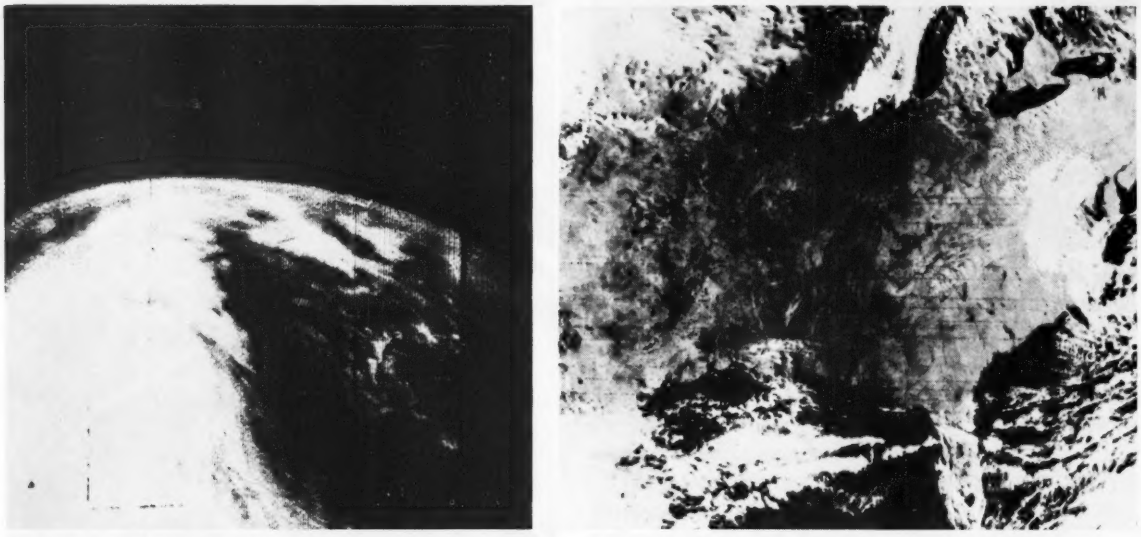
Heat Treatment Detection of Cancer

A team of engineers from NASA's Johnson Space Center, Houston, working with local cancer researchers has developed an advanced heat treatment system for use on certain types of human cancers.

The development was independent of other recently announced NASA work evaluating the use of a microwave technique to detect cancer. The Houston heat treatment method also employs microwave technology.

Research has shown that heat can destroy cancer cells without harming adjacent healthy tissue. Methods for producing the heat have become more sophisticated but until recently were plagued with problems including burns to the patient receiving the treatment.

The Johnson center had agreed in 1978 to assist bio-medical scientists of the Stehlin Foundation for Cancer Research at St. Joseph's Hospital in



Study in Contrast—The first weather picture ever returned from space, on the left, was from the TIROS–1 satellite in April 1960. The recent view of the Continental U.S. on the right was transmitted by the TIROS–N series spacecraft, the newest and most advanced in the family of meteorological satellites. In 20 years, the RCA-built trackers have returned more than 3.5 million views of the world's weather.

Houston with technical aspects of a radio frequency heat treatment system.

The engineering challenge which the St. Joseph's researchers posed to the space center technicians was to improve both the equipment and the technique. The first step was to develop a machine for testing on small animals.

The NASA center's experiment systems division has been developing the equipment with its safety and reliability division reviewing each advance in equipment or technique. Kumar Krishen, technical coordinator for the project, said "developing the advanced human system involved acute concerns about the safety and reliability of the equipment and the instrumentation used to monitor experiments."

The Johnson team delivered an experimental human treatment system to St. Joseph's Hospital in January. "The system uses a gradual buildup of power to a preselected level," Krishen said, "two pairs of electrodes concentrate the power at the tumor. Heating of the skin and surrounding healthy cells is dispersed much better with the new design."

The small animal system is being used to help establish human levels and to study the effects of heat treatment at the cell level. "The challenge we now face," Krishen said, "is to deliver the heat with minimal side effects. We are investigating the possibility of transmitting the radio waves through the patient with electrodes which do not touch the skin. They would act like antennas. Right now the electrodes must touch the patient's skin."

The experiment systems division group at Johnson normally is involved in the development of microwave devices for the study of Earth's weather, soil conditions and agricultural crops.

Researchers at NASA's Langley Research Center in Hampton, Va., confirmed last November that they are evaluating an instrument which makes use of microwave technology as a detector of cancerous tumors in the human body.

The device, called a microwave applicator, is being tested at the Eastern Virginia Medical School at Norfolk General Hospital. The project began when a Langley researcher suggested that Langley's microwave experts, who normally work on satellite communications and other related space projects, should get involved in some way with using microwave techniques to detect and treat cancer.

The device demonstrated it could locate tumors in 14 known cancer patients and also found a cancerous site in one patient which had been undiscovered by conventional techniques.

The microwave instrument contains a sensitive radiometer that can measure temperature variations of less than 0.1 degree C. Because cancerous tissues are hotter than surrounding normal tissues, they are thus detectable by the applicator.

The microwave applicator has the advantage of being used outside the body and could become relatively inexpensive if mass-produced. If it proves itself after an extensive series of hospital and laboratory tests, it could become standard equipment in doctor's offices.

Contractor News

Boeing Company, Lockheed California Company, and McDonnell Douglas Corporation have been awarded NASA contracts for continued technology studies on an advanced supersonic transport plane. Each of the major aircraft manufacturers received an approximate $1.15 million contract and each will work in the same discipline technology areas, but within their individual basic design concepts. NASA has asked the three contractors to draw on past studies and to update them, looking especially for economic considerations, reduced fuel consumption and reduced noise in supersonic cruise flight. The contracts each cover a period of about 14½ months and they will be managed by Langley Research Center.

Bionetics Corporation, of Hampton, Va., has won a contract extension of almost two million dollars for reference standards services and the calibration of instruments at Kennedy Space Center. A small business firm, Bionetics has the job of maintaining KSC measurement standards and calibrating all center test equipment, assuring accuracy in operations. The cost-plus-fixed-fee contract extension covers the period May 1, 1980, through April 30, 1981, and brings the total value of the 1976 agreement to almost $6.5 million.,

Automation Industries, Inc., Vitro Services Division, of Industrial Park, Fort Walton Beach, Fla., has been awarded a contract by the Wallops Flight Center for purchase of a Mobile C-Band Instrumentation Radar System. The million dollar, fixed price contract calls for delivery within 20 months. The new mobile radar system will replace an existing acquisition radar to update the center's tracking capabilities.

Holloway Corporation, of Titusville, Fla., has received a million dollar contract award from the Kennedy Space Center for the fabrication of power system equipment. Delivery of equipment should begin in late November 1980 and be completed by August 28, 1981. Holloway will provide direct current power systems and high frequency power systems to supply supplementary electrical power for the Orbiter processing facility and mobile launch platform facilities both at KSC and Vandenberg Air Force Base, Lompoc, Calif. Kennedy and Vandenberg are the East and West Coast launch sites for the Space Shuttle.

W. B. Venables & Son, Inc., of Mechanic Street, Laurel, Del., has been awarded a one million dollar fixed price contract by the Wallops center for construction of a new facilities operation building on the WFC main base. Completion of the building, set for March 30, 1981, will allow for most of the technical support shops (carpenter, electric welding, garage, etc.) to be centrally located. The shops are presently widely dispersed in obsolete World War II buildings.

Pan American World Airways, Inc., Aerospace Service Division, of Houston, has signed an extension to its contract with the Johnson Space Center covering plant maintenance and operations at JSC. The cost-plus-award-fee contract is for operation of all center utilities and maintenance of buildings, roads, ditches and special equipment. The contract value is set at over $9 million.

Rand Sperry Corp., Sperry Univac Division, of Blue Bell, Pa., has reached agreement with the Johnson Space Center on a $6.15 million contract covering lease and maintenance of automatic data processing equipment at JSC. The contract covers people, equipment, materials, facilities, services and management of all Univac activity at Houston.

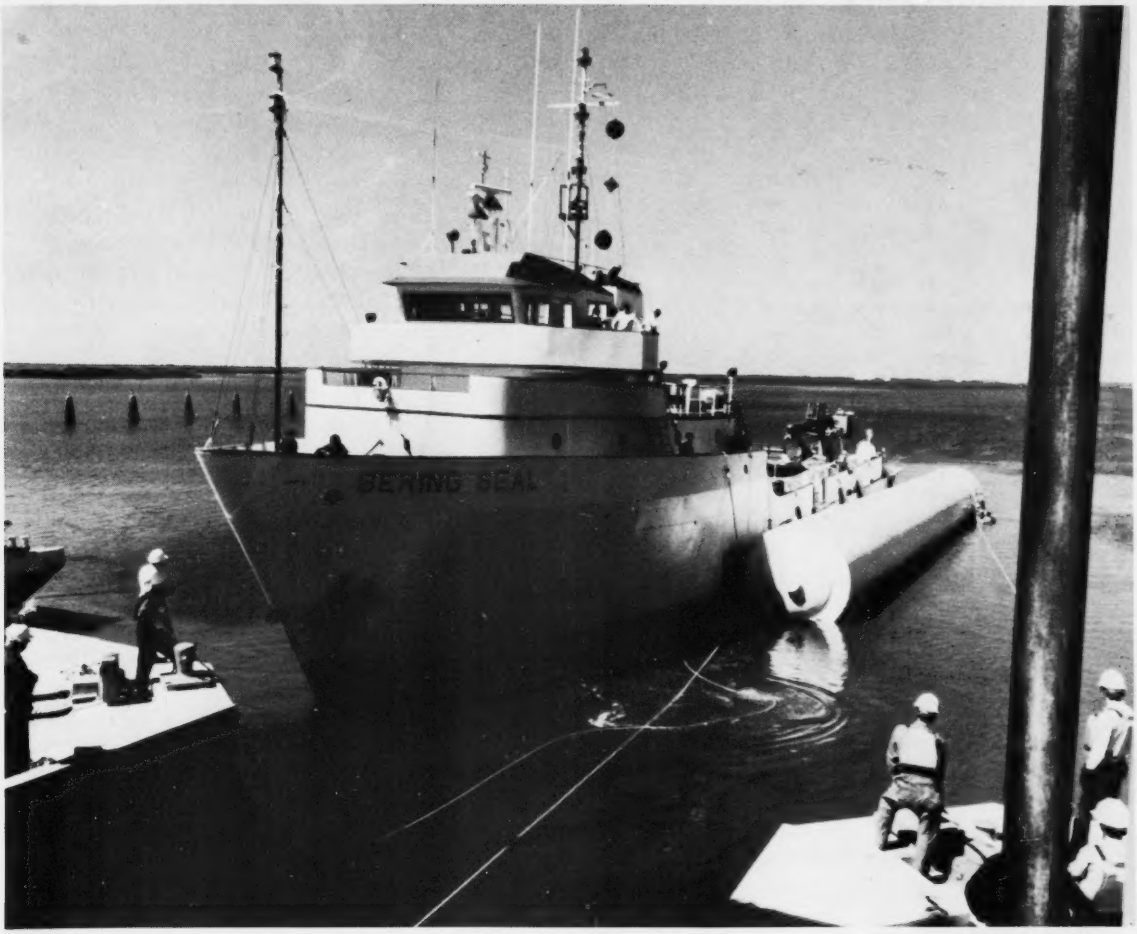
Patents for Inventions from NASA Research

The office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) & Employer	Title	Patent No.	Installation
Harry Reid, Jr., NASA/Marshall	Coal-shale interface detector	4,195,512	MSFC
William M. Ingle, Carl Goetz, Motorola, Inc., Phoenix, Ariz.	Quartz ball valve	4,195,666	NRO/JPL
Sidney R. McClure, NASA/Goddard	Method and apparatus for holding two separate metal pieces together for welding	4,196,840	GSFC
Eric G. Laue, Caltech/JPL	Passive intrusion detection system	4,197,530	NRO/JPL
Richard A. Parr, Mary H. Johnston, John C. McClure, NASA/Marshall	Preparation of monotectic alloys having a controlled microstructure by directional solidification under dopant-induced interface breakdown	4,198,232	MSFC
Warren W. Christensen, Ludwig A. Mayer, Fritz H. Woeller, San Jose University, San Jose, Calif.	Chelate-modified polymers for atmospheric gas chromatography	4,198,792	ARC
Charles M. Fleetwood, Jr. Stephen H. Rice, NASA/Goddard	Method of forming a sharp edge on optical device	4,198,788	GSFC
Michael J. Mirtich, James S. Sovey, NASA/Lewis	Modification of electrical and optical properties of polymers	4,199,650	LeRC
John T. Polhemus, Wilbur H. Cash, Martin Marietta, Denver	Pulse transducer with artifact signal attenuator	4,198,988	DFRC
Catherine C. Johnson, Theodore J. Wydeven, NASA/Ames	Reverse osmosis membrane of high urea rejection	4,199,448	ARC
Israel Paz, NASA/Johnson	Tri-State delta modulator	4,199,722	JSC
William F. Williams, Seymour B. Cohn, Caltech/JPL	Dual band combiner for horn antenna	4,199,764	NRO/JPL
Anthony Fortini, John M. Kazaroff, NASA/Lewis	Heat exchanger and method of making	4,199,937	LeRC
Earl R. Collins, Jr. Caltech/JPL	Geological assessment probe	4,196,619	NRO/JPL
Kazimiera Paciorek, Ultrasystems, Inc., Irvine, Calif.	Heat resistant polymers of oxidized styrylphosphine	4.200,721	JSC

Launches for 1980

Name	Launch Date	Vehicle	Range	Mission Remarks
FLTSATCOM-C	January 17	Atlas Centaur	ETR	DOD Navy. Reimbursable
SMM-A	February 14	Delta	ETR	NASA. Scientific Solar Maximum Mission.
NOAA-B	May	Atlas-F	WTR	NOAA Weather. Reimbursable.
GOES-D	August	Delta	ETR	NOAA Weather. Reimbursable.
Intelsat V-A	September	Atlas Centaur	ETR	Intelsat communications. Reimbursable.
Navy-20	October	Scout	ETR	DOD Transit. Reimbursable.
SBS-A	October	Delta	ETR	Satellite business systems. Reimbursable.
FLTSATCOM-D	November	Atlas Centaur	ETR	DOD Navy. Reimbursable.
Intelsat V-B	December	Atlas Centaur	ETR	Intelsat communications. Reimbursable.



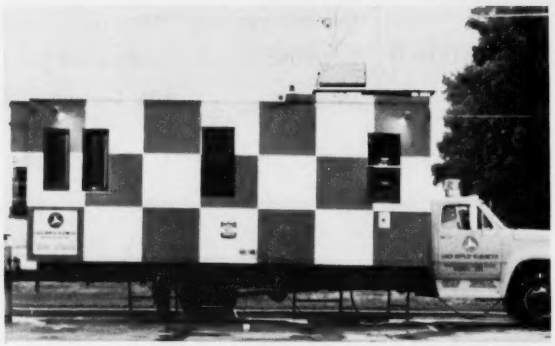
Docking the Booster—At the Kennedy center's Hanger AF slip, a leased recovery ship delivers a Space Shuttle solid rocket booster simulator now being tested in Port Canaveral waters. During sea exercises, ships will pick up the booster frustums and parachutes, then steer a nozzle plug remotely into the aft end of the simulator and take it into tow.

Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Airport Safety Aid

Large aircraft such as commercial jetliners produce powerful wakes, or vortices, which can be hazardous to small planes following closely behind. For that reason, the Federal Aviation Administration requires a five-mile spacing between large and small aircraft approaching a runway, to allow time for the vortices to dissipate. This restricts landing operations, particularly at busy terminals, and contributes to airport congestion.



With an eye toward reducing the spacing requirement while assuring lightplane safety, the Department of Transportation is conducting research on the characteristics of aircraft wake. A spinoff system, pictured below the jetliner and atop the checkerboard van, is producing valuable information to enable airport controllers to determine when it is safe for a lightplane to land. Developed by Lockheed Missiles and Space Company, Sunnyvale, Calif., it is called a Laser Doppler Velocimeter.

The device was originally developed by NASA's Marshall Space Center for use in measuring airflow disturbances in wind tunnels and in flight. Lockheed, which worked on the project, applied the experience to its new remote wind sensing device. To date, it has monitored thousands of airliner landings to better the airport traffic system.

For the benefit of all . . .

* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of such technology.

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